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MONTHLY JOURNAL OF
THE MUSHROOM GROWERS'
ASSOCIATION

MGA BULLETIN

FEBRUARY, 1958 · NUMBER 98

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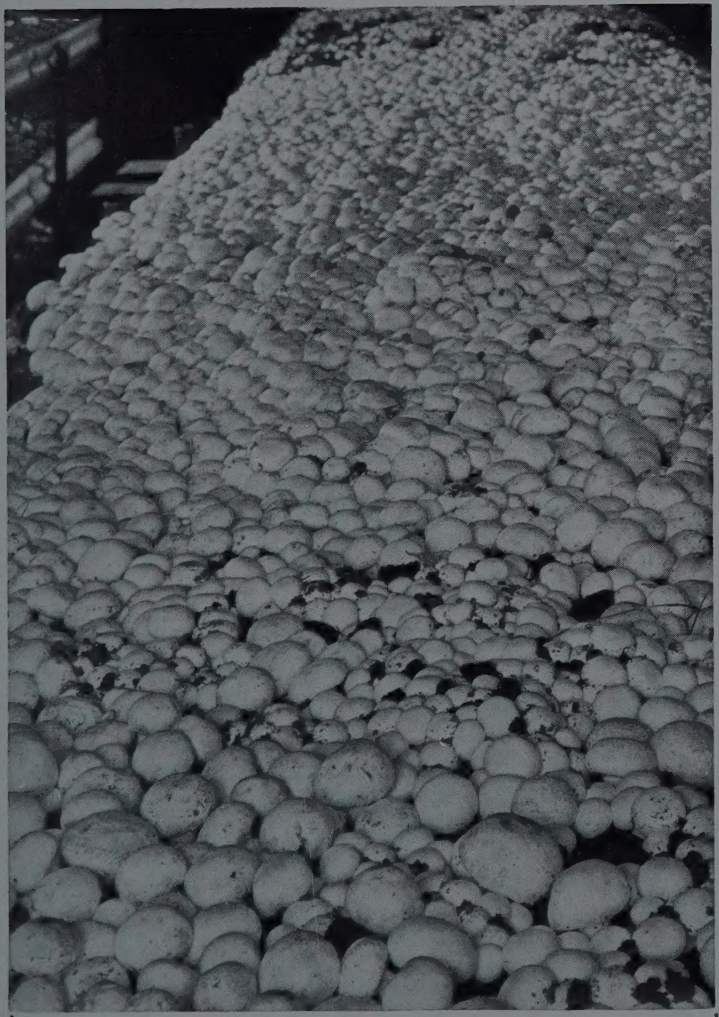

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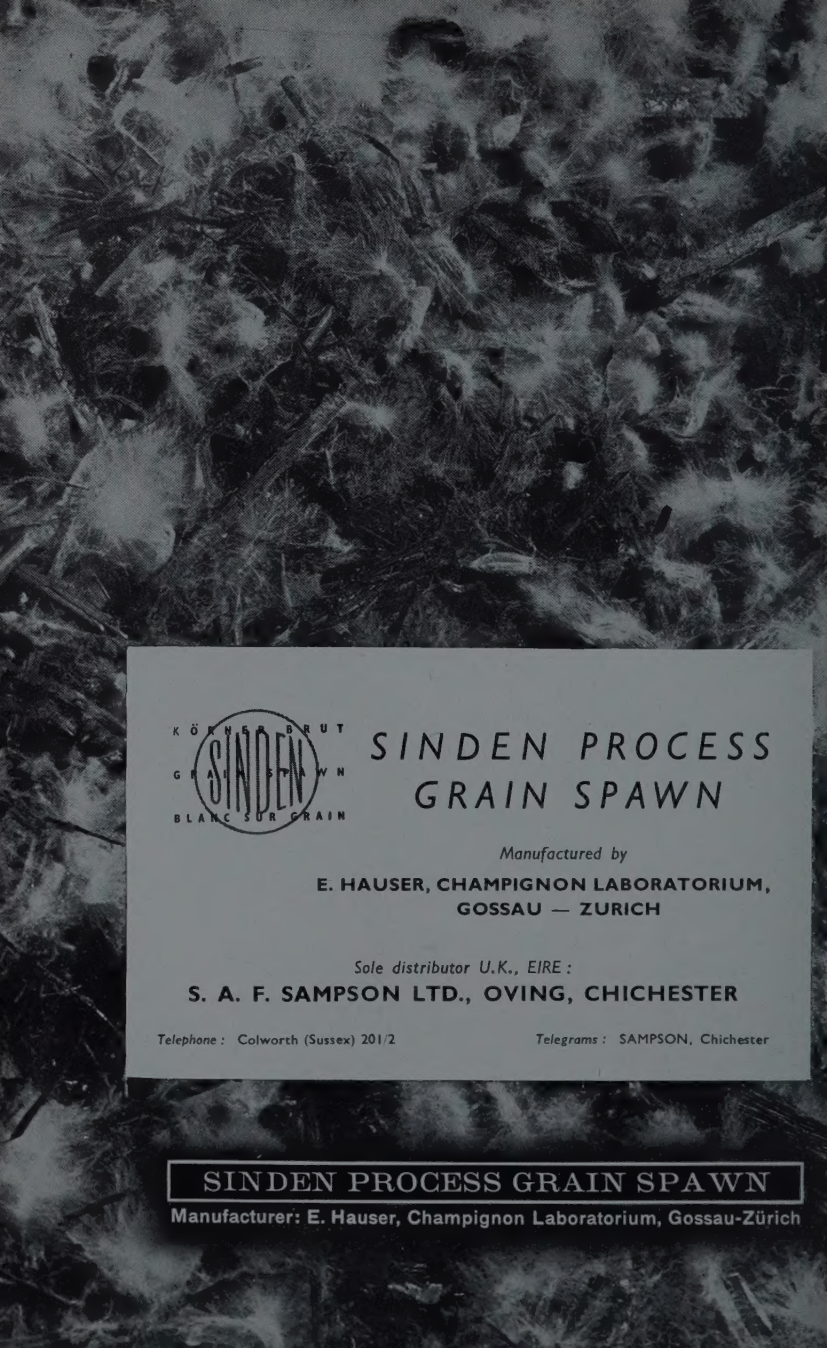

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EDITORIAL

PATIENCE

The quick response of the Glasshouse Crops Research Institute, and the National Agricultural Advisory Service in general, to the MGA's plea for immediate and thorough investigation into the recent mushroom disorder, which shows little sign of abating, should be a matter for considerable satisfaction to those engaged in the cultivated mushroom industry.

As the meeting at the GCRI revealed—it is reported in this issue—there is a ready awareness amongst the horticultural boffins with an interest in mushrooms of the seriousness of the problem, both as it affects individual growers and the industry as a whole.

Would that it were possible for someone to immediately pinpoint both the cause and the cure, but alas this, to put it mildly, is unlikely.

It is pretty well inevitable that progress will be slow as scientific opinion must have proof, all along the line and with each step, before a further step forward is taken. The solid achievement rather than the spectacular is invariably the scientist's lot.

Sympathetic then though we are to those whose production has so sharply declined of late and to whom the onset of this disease has quickly resolved into a struggle for existence, there is as yet little hope to offer of any immediate improvement and for those so affected the way ahead is bound to be somewhat laborious. Whilst they individually grapple with their own personal problems they will without doubt derive considerable comfort from the knowledge that a collective effort, of no mean proportions, is being mounted at the top ensuring that one day—and let us all hope it is not far distant—full information on this disease will be neatly pigeon-holed together with the cause, the effect and the cure.

WRA

"LA FRANCE"—ET CETERA?

A Progress Report by Fred. C. Atkins

The trouble at G. V. Allen's farm in Kent was La France Disease. We have Dr. J. W. Sinden's word for it. And we all hope that very soon our Chairman will be benefiting from his adoption of the drastic control measures outlined by Sinden and Mrs. E. Hauser on page 409 of *MGA Bulletin* 96 (December/57). But what is La France? Is it identical with Brown Disease? And with Watery Stipe? Are Brown Disease and Watery Stipe the same thing?

Many MGA members want to know, and the Executive is being asked what is being done to find the answers. As chairman of the MGA Research Committee I have been asked to report to you. In doing so I fear I shall present a confusing state of affairs but hope to satisfy members that all is being done that can be done, and that there is now a real sense of urgency everywhere.

We must go back to 1955. The devastation caused by La France Disease in the South of England was then so serious that the MGA Research Committee approached Lord Rothschild, chairman of the Agricultural Research Council, for guidance. Subsequently Raymond Thompson and I discussed the matter at Cunard House with G. G. Samuel, scientific adviser on the plant pathology side of the Council's activities.

Miss Doreen Gandy was then working on a long-term investigation of mushroom disorders and abnormal development which were widespread and devastating. I remember Samuel saying to us: " I am under no illusions that these problems will be easy to solve. The mushroom is such a lowly organism that it cannot react in many different ways to the wide range of injurious factors. This may partly explain some of the confusion." He suggested Miss Gandy should continue her studies, and he has taken a close personal interest in them ever since.

It was at about this time that I visited Stanley Middlebrook's farm in Yorkshire and saw a serious and sustained disorder unlike anything either of us had seen before. He referred to it as " Browns," but to avoid confusion with brown strains I suggested we called it " Brown Disease." It was referred to from time to time in the *MGA Bulletin*. Last summer, in different parts of the country, mushrooms were dying and turning brown and the Mystery of Brown Disease was upon us.

When I was entrusted with the organisation of the lecture side of the Southport Conference I naturally asked Dr. I. F. Storey to give us his views because he was at that time studying dying mushrooms in Leicestershire and Warwickshire where Brown Disease had been reported. He preferred to call the trouble Watery Stipe, however, for watery streaks up the stalk and watery lesions within appeared to be constant characteristics on all the farms he had visited.

Allen by now was in serious trouble on his farm, and the Southport

gathering provided a timely opportunity for an informal discussion, reported at some length in *MGA Bulletin* 96 (December/57). It was shortly afterwards that Sinden visited Allen and identified his disease.

In November the MGA convened a private meeting at Agriculture House, London, at which a cross-section of growers in trouble detailed the multitudinous symptoms to scientists and NAAS officers who were interested. Dr. R. L. Edwards, former MRA director of research at Yaxley, presided. A digest of the discussion was in due course sent to the ARC, the Glasshouse Crops Research Institute, and to the NAAS.

The next step was a top-level scientific conference at Littlehampton, presided over by F. W. Toovey, Director of Research at the GCRI. With him were Professor W. Brown, Chairman of the Institute's research committee; J. J. Baker, of the Ministry's Plant Pathology Laboratory at Harpenden; Dr. B. E. Plunkett, of Birkbeck College, London; G. F. Sheard, director of Fairfield Experimental Horticulture Station; A. J. Bedding, representing F. G. Smith, director of Stockbridge House Experimental Horticulture Station; Dr. H. H. Glasscock, Dr. I. F. Storey and B. B. Till, NAAS pathologists; B. D. Moreton, NAAS entomologist; and the following staff members of the Littlehampton Institute: P. H. Williams and Miss D. G. Gandy, pathologists; P. B. Flegg, soil chemist; Dr. N. W. Hussey and I. J. Wyatt, entomologists; and L. A. Darby, plant breeder. I was present as an observer on behalf of the MGA. Unfortunately G. G. Samuel, W. C. Moore and Dr. R. L. Edwards could not attend.

The purpose of this conference was to enable the scientists to get together and draw up a plan of campaign, co-ordinating their efforts where possible. At the close everyone felt this object had been achieved.

Miss Gandy discussed her laboratory experiments in which she had used cultures of mushroom mycelium and tissue taken from outbreaks of the disorder. She supported Sinden's view that mycelium taken from infected compost did not behave normally, but she had not yet had an opportunity to carry out the inoculation experiments he had suggested. She hoped to continue this work in beakers or in small trays as soon as the new buildings were complete this Spring.

Moreton described his Wye experiments with beakers. Casing from "diseased" trays on Allen's farm produced abnormal mushrooms with caps small in proportion to stems, stems abnormally shaped, and rings poorly developed. All the beakers cased with peat-and-chalk from Allen's diseased trays produced these symptoms; half the mushrooms grown were misshapen. From all the other beakers, treated in a variety of ways, only two mushrooms out of 132 were abnormal, and they appeared on beakers watered with coarse-filtered washing from Allen's diseased casing.

Darby stressed the fact that a mushroom, whether normal or abnormal, results from the interaction of its genetic determinants with the environment. He suggested that the disorder might have a strong genetic component, and compared it with June yellows in the strawberry variety Climax.

Plunkett spoke of his work with another agaric, *Collybia velutipes*, pointing out that cap development in particular was highly sensitive to the environment. I took the opportunity to mention that both nematodes and Mat Disease could produce symptoms somewhat similar to those of La France, and that Storey and Till had been able to demonstrate an association between Watery Stipe and excess water in the air. And Storey was of the opinion that in time it would be possible to forecast outbreaks of Watery Stipe.

Graphs were presented revealing the phenomenal speed-up of mushroom production in recent years. The metabolic rate was at least doubled, yet only a few growers had adequately increased the amount of fresh air introduced. On one farm, said Storey, all the symptoms had disappeared with the transfer of trays to ducted cropping rooms.

Flegg said he had been in correspondence with the National Institute of Agricultural Botany at Cambridge over Capelle-type straws. There was substantially no difference in chemical analysis, but undoubtedly these hard straws demanded changes in the technique of composting. They had just filled a mushroom house at the Institute with Capelle compost to study its behaviour.

The discussion ranged over a very wide field—genetics, cytology, morphology generally—and all were obviously concerned at the serious lack of fundamental knowledge of the cultivated mushroom, *Psalliota hortensis:* the paucity of such data makes problems of abnormalities correspondingly more difficult.

But I left the conference stimulated and encouraged. Sinden has stated that, while not disregarding the probability of physiological relations, he regards the problem as primarily a phytopathological one. At Littlehampton work along these lines is to be stepped up, with the NAAS sending samples from seriously affected farms from time to time as the increasing facilities permit. If transmission is found to be repeatable the search will be concentrated on finding the infective principle.

In the meantime the study of environmental influence will be continued by the NAAS; and at Littlehampton efforts will be made to devise suitable cropping cabinets in which the atmosphere is variable at will.

I hope that the samples forwarded by the NAAS will include some from Middlebrook (Yorkshire), Graham Griffiths (Somerset) and Thompson (Sussex). Why? Glasscock, who is the NAAS specialist on mushroom diseases, and whose experience goes back to the pre-war years, recently expressed an opinion which a number of us share. "I find it difficult to believe we are dealing with only one disease," he said. "Drumsticks, watery stipes, bacterial ooze from gills, German helmets, brown buttons and failure to crop in areas have occurred for so many years in mushroom growing and have not been major disasters nor continuous from crop to crop, and I have a feeling that one disorder is definitely infective and the other is not."

Middlebrook has stated: "I am convinced we are dealing with two different things. I do not necessarily have abnormal shapes; for the most part they are perfect mushrooms." He had shown a sample to Sinden who had said: "This might be something different."

Griffiths has reported that Sinden had visited his farm and said: "I have never seen this before, and I don't know what it is."

Thompson had La France Disease several years ago, and should know what it looks like. His 1957 trouble was "something different," he says.

WHO'S WHO: ERICH HULLEN

President of the Bundes der Champignonzuchter Deutschlands, Herr Erch Hullen of Erlangen, Germany, celebrated his 70th birthday on 26th January, and, with fifty years' experience in the mushroom growing industry he is probably the most experienced grower in Germany.

Herr Hullen, who has been President of the German Federation for the past nine years, being elected to that office a year after the Federation was formed and who, a few months ago, was elected to a further period of office of three years, was born in Osterode in 1888, the son of Wilhelm Hullen, himself a well-known mushroom grower.

After completing his college studies in 1907, Herr Hullen went to Frankfurt to gain experience with mushrooms and subsequently assisted his father for many years at Osterode/Harz, becoming a partner in the firm.

In 1923, he started his present farm at Erlangen, took an active interest in the Botanic Institute there and, in 1933, founded the Laboratoriu für Champignonbrut also in Erlangen.

Writing of the great part Herr Hullen (pictured herewith) has played in the development of the Mushroom industry in Germany, a colleague says "I should like to say that Herr Hullen has done great service to mushroom growing within the Union. It is thanks to him that the German mushroom growers have been able to keep step with the growers in America, England and France."

Herr Hullen, member of the MGA has, with a few other German growers visited a number of countries to study mushroom growing.

The MGA adds its congratulations to him, both on attaining 70 years and on his work for the industry in general.

That Mushroom Questionnaire (Concluded)

A SURVEY OF CULTURAL PRACTICES 1956-1957

By P. B. FLEGG

Glasshouse Crops Research Institute

The 1956 questionnaire required a much more detailed reply from growers than did the earlier surveys, and from the data given in the replies it has been possible to examine and analyse the cultural methods of the industry more carefully than ever before.

The main lines of enquiry have been to discover whether there are any major differences in growing methods associated with a grower's experience or the size of his farm, and to examine the essential differences between tray and shelf methods of growing. An attempt has also been made to see whether there is any common factor in farms reporting average yields of 2 lb. per square foot or more.

Experience of Growers and Size of Farm

Replies were divided into four age groups, based on the replies to the question on length of occupation of farm. This was taken to be a measure of the experience of the grower, though it is realised that some replies may have been from experienced growers who had occupied their present farm for only a short period.

The " age " groups were:—

(*a*) up to 2 years' occupation—beginners.
(*b*) from 2 to 10 years' occupation—post-war growers.
(*c*) from 10 to 20 years' occupation—pre-war growers.
(*d*) over 20 years' occupation—senior growers.

These groups were further split up according to the size of the farm:—

(i) up to 5,000 sq. ft.—small.
(ii) 5,000—15,000 sq. ft.—medium.
(iii) 15,000—30,000 sq. ft.—large.
(iv) over 30,000 sq. ft.—very large.

Of the 79 farms on which this survey is based there were 19% which were classified as managed by beginners, 60% by post-war growers, and 21% had been occupied for ten years or more. The industry is thus apparently made up largely of post-war growers as nearly 80% of the growers in the survey had occupied their farms for less than ten years. This must surely bode well for the future and will no doubt favour the development of new ideas and an up-to-date approach to the problems of the industry. About a quarter (27%) of the replies came from small farms, 43% from medium-sized farms, 19% from large farms, and very large farms of over 30,000 sq. ft. made up the remaining 11% of the total.

The two main methods of growing, on trays or shelves, did not seem to be predominantly favoured by any one age group or to be related to the size of farm. Post-war growers with medium-sized farms seemed to show some preference for trays, but within the same age

group the small farms and larger farms (15,000—30,000 sq. ft.) tended to favour shelves. It is interesting to note that among the beginners, trays and shelves were equally divided. Although the tray system has gained some ground over the past few years the shelf system was still in the lead at the time of this enquiry.

Light horse manure was the most common basic material for composting and was used by all beginners. Some of the more established growers used only heavy manure, but the majority used light manure either exclusively or in combination with heavy manure.

The proportion of growers who composted for less than two weeks, two to three weeks, or over three weeks was more or less the same in all groups; none of the senior growers, however, composted for more than three weeks.

As regards cropping and yields, the majority of growers in all groups, or 66% of the total, obtained between two and four crops a year, and, surprisingly, three growers of over twenty years' standing obtained no more than two crops a year. The majority of growers in all groups, or 58% of the total, reported average yields of between 1—2 lb. per sq. ft.; about 11% admitted less than 1 lb. per sq. ft., and 20% claimed over 2 lb. per sq. ft. It is interesting to note that not one of the farms of over ten years' occupation averaged less than 1 lb. per sq. ft., and one wonders if this is not a warning to growers who cannot exceed the 1 lb. mark that they will be out of business before their ten years is up.

The fact that there are few distinct differences between the age and size groups suggests that beginners are not prevented from drawing on the experience of more established growers and that the basic methods of growing do not vary much with the size of farm.

Trays *versus* **Shelves**

If mushroom growers must be divided then the most fundamental division is between those who use the tray system and those using shelves. The replies to the questionnaire were therefore separated into these two groups and the characteristics of each group compared. The shelf system of growing was the more common by a small margin, 52% using the shelf system only, 42% trays only, while 6% used both systems.

The difference in basic composting materials was slight; more shelf growers used mixtures of light and heavy manure than tray growers, and nearly all users of synthetic compost belonged to the shelf group. There were, however, distinct differences in the methods of composting. More than 50% of the tray growers completed composting within fourteen days as against 20% of the shelf group, and only 18% of the tray group took longer than three weeks with their composting compared with one-third of the shelf growers. Tray growers were thus definitely in favour of a shorter period of composting. They were also generally able to case much earlier, about 50% of the tray group casing within two weeks of spawning compared with 25% of the shelf growers who, on the whole, cased about a week later; 50% of the shelf group cased within two or three weeks of spawning, and 7% of this group waited for at least four weeks after spawning before casing. As would be expected

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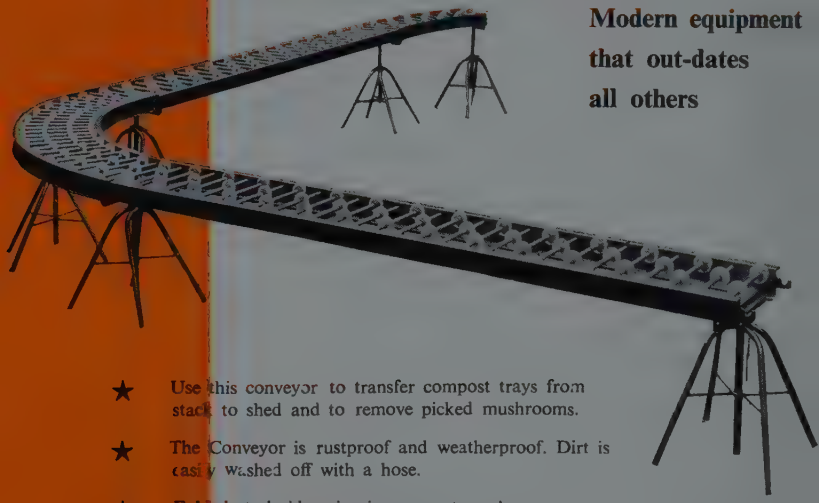

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from the distinct tendency of the tray growers to case earlier they were also generally able to start picking much earlier. The differences are probably due to the inherent characteristics of the two systems; it does not follow that if shelf growers cased earlier they would necessarily obtain earlier cropping.

It is not surprising to find that there were distinct differences in cropping period, 64% of the tray growers cropping for eight weeks or less compared with only 12% of the shelf group. At least 50% of the shelf growers cropped for ten weeks or more. These differences in cropping periods are of course reflected in the number of crops obtained per house per year. However, although over 60% of tray growers cropped for eight weeks or less only 30% obtained more than four crops a year, while only 5% of the shelf growers led this hectic life. These figures cause one to wonder whether tray growers always operate the system as efficiently as they might and whether some of them may be failing to obtain the maximum number of crops per year.

The majority of growers who used the tray system claimed average yields of 1—2 lb. per sq. ft., as did the majority of shelf growers; nearly all growers who claimed more than 2 lb. per sq. ft., however, were in the shelf group.

Methods of heating the growing houses showed some differences, though a considerable number of growers omitted to complete this section of the questionnaire. The most common heating combination was solid fuel boilers and hot water pipes. Oil firing seemed to be more common among the tray group, 35% of tray growers using this method compared with 10% of the shelf growers. Forms of supplementary heating for peak heating also showed some differences, live steam being more favoured by the tray group and braziers more common among shelf growers; nearly 50% of the shelf growers used braziers. Although there were these differences between the groups in the method of peak heating no differences were found in the duration of peak heating or in the temperatures attained. All growers who practiced peak heating claimed temperatures of over 120° F. in the top beds (or trays), though a few had difficulty in getting bottom beds (or trays) to this temperature.

The temperature maintained during spawn run and cropping tended to be higher among tray growers than shelf growers and may be connected with the characteristic earlier, shorter cropping period generally achieved by tray growers.

In casing practice there was little difference, the great majority of growers of either group using peat mixtures; the few remaining growers who used soil were mainly shelf growers. The most popular casing was peat and lump chalk, and about half the shelf growers also added carbonate of lime compared with only a quarter of the tray group. Only one grower, a tray man, applied the peat dry; about a quarter judged it to be moist on application, but the majority of those who answered the question described the peat as saturated when applied.

No differences in methods of ventilation were apparent, floor and roof vents being the most common. Only 10% of the total sample had installed fans with ducting and these were equally divided between the tray and shelf groups.

A general appraisal of the standard of hygiene of the two groups gives the impression that shelf growers take greater care. There is a greater tendency among shelf growers to heat up and fumigate houses before emptying, and more shelf growers than tray growers remove spent compost from their farms. This may be connected with the longer cropping period of the shelf system which is more likely to allow pests and diseases to become established.

High Average Yields

Of 79 replies, 16, or about 20%, came from growers who claimed average yields of over 2 lb. per sq. ft. per crop. It was decided to examine this group more closely to discover whether these growers had anything in common in their methods which might be connected with high yields. Only twelve out of sixteen could be regarded as being high yielding farms, however, because four referred to farms reporting no more than two crops per house per year.

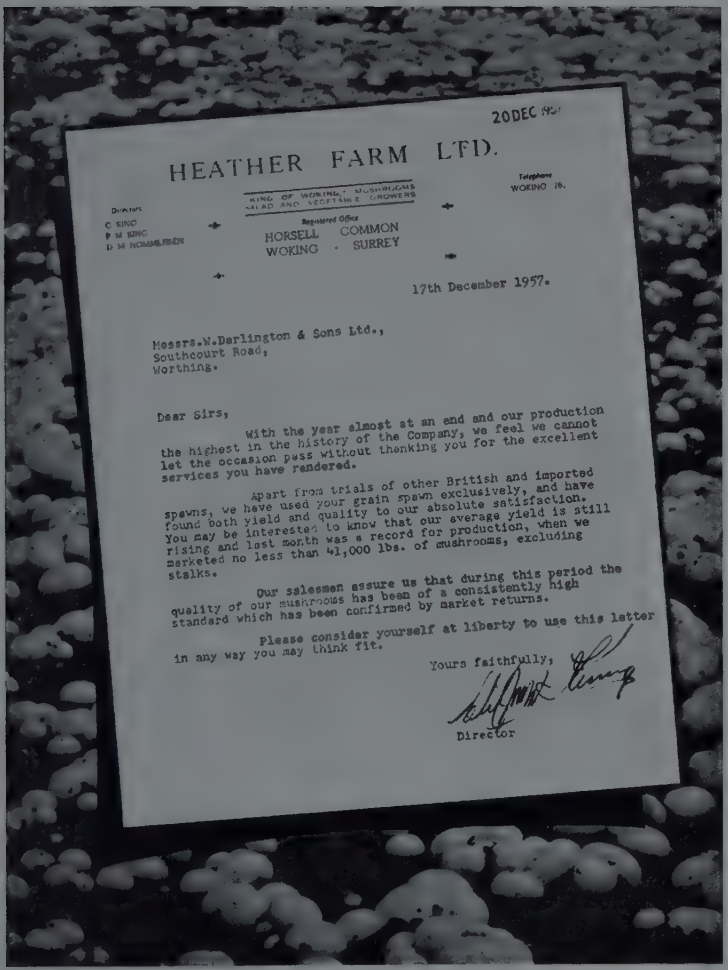
Most of the twelve growers used the shelf system, and it is interesting to find that of those who claimed an average yield of 2 lb. per sq. ft., between two and four times per year, a third used MRA synthetic compost. The eight other growers used both heavy and light manure. The majority ran their spawn at temperatures exceeding 65° F. and did not usually exceed 60° F. during cropping. Thermostatic control of heating was installed on six of the farms.

In general it appears that the high average yields were obtained mainly on the shelf system in which the cropping period is longer than in the tray system. Probably the main reason for the high yields is not to be found in any one operation but in care and attention to detail throughout—in other words, in just good growing. Is it significant that nearly all of the growers who use MRA synthetic compost were in the group which obtained high average yields?

1958 PUBLICITY SUBSCRIPTION CAMPAIGN OPENS

The 1958 Publicity Fund Subscription Campaign has got under way with a special appeal to all those engaged in the industry in addition to actual growers.

The first firm of salesmen to subscribe in 1958 was **Messrs. A. Williamson (19) Ltd.**, Smithfield Market, Birmingham 5, with a contribution of £5 5s. This firm did, in fact, contribute to the 1957 fund but, in error, their contribution was not acknowledged in the list of subscribers which appeared each month in the *Bulletin*.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WORLD'S PRESS DIGEST

The possible **function of the casing layer** in commercial mushroom production was investigated. Normal fruiting resulted when mycelium-impregnated compost was cased with the same, but unspawned, compost; normal fruiting also occurred when moistened silica sand was used as casing. It was shown that a generous rate of air movement over the surface of the casing soil was important for normal initiation of sporophores. A fluctuating pattern of respiration was normal in mushroom metabolism. Respiration in cased flasks increased for a period of 6 to 13 days starting soon after casing; there was another momentary increase at the time of "clump" formation, and a third increase with the rapid growth of the pinheads. It is suggested that the mycelium produces a hormone-like substance of high molecular weight and low volatility; the casing layer inhibits the volatilization and/or diffusion of this substance, which builds up to the concentration required to stimulate fruiting of the mycelium in the compost. The same substance may also inhibit fruiting if present in too high a concentration by adversely affecting the rhizomorphs in the casing layer.

L. C. Schisler in *Publication* 20,973 of Pa. State University, 1957; summary reprinted from *Horticultural Abstracts*, December/57.

In all the wide world there is only one **restaurant,** according to gourmets and seasoned travellers, that invariably serves a platter of mushrooms at every table at every meal. This is Marchi's, a quiet, unpretentious, pleasant place in an old brownstone house at 251 East 31st Street, just west of Second Avenue, in New York City.

AMI's *Mushroom News*, December/57.

Rye seeds were soaked in 0·1, 0·5, 1·0 and 1·5 per cent. solutions of **lindane** (a commercial formulation containing 5 per cent. of the toxicant) for 3, 6, 12 and 24-hour periods. Even the shortest exposures to the most dilute solutions induced various irregularies in cell division processes and some polyploidy was observed, but the toxic effects of the treatments prevented normal completion of germination. (R. Bravo in *Acta Agron.* Columbia, 6, 3, 1956).

Biological Abstracts, December/57.

Oven-made compost was no more homogeneous than that made by standard methods. There was very little conversion of added mineral P into organic farms. Mushroom growth was not adversely affected by **radio-activity** up to 1·66 millicuries per kg. of fresh manure. The gill surface and outer parts of the stalks were rich in P. Growth on malt agar was improved by radio-activity at initial activities of 19×10^{-4}—$16{\cdot}5 \times 10^{-1}$ microcuries per g. of medium. Mycelial morphology was not affected. A Willam in *Report for* 1955-56, Gembloux Section, of Committee for Application of Isotopic Methods to Crop Research.

Horticultural Abstracts, December/57.

An analysis of the **vitamin and mineral content** of mushrooms is now being conducted at the Food Research Laboratory in Long Island City, New York. The study will cover thiamine, riboflavin, niacin,

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Yours faithfully,
(signed) A. Sanford.

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ascorbic acid, pyridoxine, pantothenic acid, folic acid, Vitamin B12 choline, inositol and biotin. AMI's *Mushroom News*, December/57.

The outstanding feature of November **weather** was the way in which there was for a long time in the south-east very little difference between day and night temperatures . . . . . This meant that high relative humidities were maintained throughout the 24 hours. Some pathologists attribute the recent spread of disease among mushrooms to this type of weather, and it is certain that under such conditions evaporation is restricted and surfaces tend to stay moist.

L. P. Smith in *Grower*, December 14/57.

Monsieur Dekeirel reported to the French Mushroom Growers' on a review of **Mushroom Science 3** in the *MGA Bulletin*, in which Dr. Edwards regretted certain short-comings in the English text. Unfortunately it had been impossible to revise the corrected proofs, and some errors of this nature were inevitable, Monsieur Dekeirel suggested. Indeed, in *Mushroom Science 1*, printed in England, there were 33 mistakes in the 13 pages of French text!

Bulletin of the French Federation, November/57.

The Department of Agricultural Economics at the University of Delaware is planning to make a **marketing cost analysis** this winter. Particular emphasis will be placed on the cost of harvesting, packing and handling mushrooms at the farm.

AMI's *Mushroom News*, December/57.

The new **Mushroom Queen** in the United States is Gretchen Dahm, 35-24-35 Chicago-born lovely. AMI's *Mushroom News*, November/57.

Recent University of Delaware experiments supported by the American Mushroom Institute indicate that **vacuum cooling** of fresh mushrooms is not economically justified at this time.

AMI's *Mushroom News*, November/57.

Mushrooms made up the second course of the banquet menu served to **Queen Elizabeth,** Prince Philip, and 248 other distinguished guests at famous Williamsburg Inn, Virginia, on the evening of 16th October. Perhaps those in charge of the banquet remembered that the Queen, who first visited this country as a royal princess eight years ago, told the hosts at a banquet in Canada that she was extremely fond of mushrooms.

AMI's *Mushroom News*, November/57.

Floor heating is becoming widely used (by the building industry) but experience is still limited on a number of practical problems in the construction of such floors. In a solid ground floor it seems desirable to have a layer of insulating material below the heating elements and also a damp-proof membrane to prevent the rise of ground moisture when the heating is turned off . . . . . One of the best ways to protect buried pipes or the sheathing of electric cables against corrosion is to make sure that they are completely surrounded by a dense concrete.

Building Research, 1956 (D.S.I.R.)

FACTS

A GROWER SHOULD KNOW

It is only a few years since SHIRLEY ACTIVATOR M was first put on the market. At that time it had been given crop tests under widely different growing conditions—as a so-called synthetic and as an additive to stable manure—on shelves and trays. Since then several thousands of tons have been used and the present rate of sales is higher than at any time. Although SHIRLEY—M may be young the technical experience behind it is considerable. It is backed by a first-class laboratory in the control of fully qualified men and is made in a works second to none in efficiency. We have introduced many other products after similar type tests and backed by the same scientific knowledge and production skill. These too are gaining in popularity and usage.

Next Spring we shall introduce further new products. The prospective user of these and any other SHIRLEY product can have every confidence in them. Our products are now being used in places so widely separated as Australia, Ascension Is., Channel Is., Continental Europe and all parts of the British Is., and Eire.

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One of the most interesting new developments in the field of food marketing is the successful experimentation done with **radiation preservation.** Mushrooms were " freeze-dried " by Dr. David A. Copson at the food research laboratories of the Raytheon Manufacturing Company. Microwave energy caused the drying action to occur. Very little colour and texture change resulted, and the treated mushrooms can be stored almost indefinitely at room temperatures.

AMI's *Mushroom News*, November/57.

It is essential not merely to ask sensible questions but also to know the kind of answer that it is reasonable to expect, said Sir George Thomson in his lecture at Southampton, " The Strategy of Research "; and this is obviously allied to what he claimed is the most important gift of all in **research**—that of choosing the right subjects.

Nature, December 7/57.

Hurst and Son Ltd. have accepted the agency in this country for **giberellic acid.** They state in their circular: " This material has reacted favourably on vegetable plants, but at present the U.S. Department of Agriculture does not recommend its use on vegetables."

Nurseryman, Seedsman, December 5/57.

Major H. Legge-Bourke commented in the House of Commons: " It seems to me that the powers now being taken under the **Import Duties Bill** by the Treasury and by the Board of Trade are powers which are so dominant that if it happened to suit the Government of the day to take a particular line it would wreck the horticultural industry as a whole." *Nurseryman, Seedsman*, December 12/57.

" Vulcan," an **electronic insect-killer,** has been recommended for South African orchards and fruit stores. Safe to humans, it kills any insects coming into contact with the grids. An orange bulb attracts the insects. *Grower*, December 7/57.

" Deadline," a new insecticidal lacquer containing **dieldrin,** can be applied by brush or spray and is said to be effective for two years or more. It is manufactured by Associated Fumigators Ltd., London, E.16. *Commercial Grower*, December 27/57.

Wind-tunnel studies showed that spores of the " *Mat* " *fungus* infecting mushroom compost were little disturbed from the substratum at low wind speeds, but readily dispersed at high speeds or by disturbing the dry compost. Further experiments are in progress to determine whether beds normally become infected by air-borne spores.

J. M. Hirst and O. J. Stedman in *Annual Report of Rothamsted Experimental Station*, 1956.

No reports have yet been received which suggest that crops respond to the light of artificial moons. *Horticultural Abstracts*, December/57.

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Agriculture, H.M.S.O., York House, Kingsway, London, W.C.2.
Agricultural & Horticultural Engineering Abstracts, National Institute of Agricultural Engineering, Wrest Park, Silsoe, Beds.
AMI's *Mushroom News*, 20 West State Street, Avondale, Pennsylvania, U.S.A.
B. & G. Review, 27 St. James Street, Covent Garden Market, London, W.C.2.
Biological Abstracts, University of Pennsylvania, Philadelphia 4, Pa., USA.

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Chemistry & Industry, Society of Chemical Industry, 14 Belgrave Square, London, S.W.1.
Commercial Grower, 154 Fleet Street, London, E.C.4.
Darlington's *Mushroom News*, Southcourt Road, Worthing, Sussex, England.
Digest of Equipment, 3 Cranston Drive, East Didsbury, Manchester 20.
Food Investigation, H.M.S.O., York House, Kingsway, London, W.C.2.
Fruit Trades' Journal, 6/7 Gough Square, Fleet Street, London, E.C.
Grower, 49 Doughty Street, London, W.C.1.
Horticultural Abstracts, Commonwealth Agricultural Bureaux, Farnham Royal.
Memo. from Monro, Geo. Monro Ltd, Waltham Cross, Herts.
Mycologia, New York Botanical Garden, Prince Street, Lancaster, Pennsylvania.
Nature, Macmillan & Co. Ltd., St. Martin's Street, London, W.C.2.
Nurseryman, Seedsman & Glasshouse Grower, 62 Doughty Street, London, W.C.1.
Packaged Food Selling, 110 Fleet Street, London, E.C.4.
Phytopathology, Monumental Printing Co., Baltimore, Maryland, USA.
Produce Packaging, Agriculture House, Knightsbridge, London, S.W.1.
Safety Equipment & Industrial Clothing, 9 Gough Square, Fleet Street, London, E.C.4.
Soil Science, The Williams & Williams Co., Baltimore 2, Maryland, USA.
Transactions of the British Mycological Society, Cambridge University Press, Bentley House, London, N.W.1.

If the journals referred to are generally available, they are most easily obtained by placing an order with your bookseller or stationer.

SEEN THIS?—NEW STERILIZING UNIT

By BRIAN A. CULLINGFORD

Making a debut at the Southport Conference at the latter end of last year was the Maywick Mushroom House Sterilizer, a portable unit embodying a newer approach to house and bed sterilization.

At that time as indeed always for that matter, disease was very much to the forefront of mushroom growers' minds and interest in this powerful newcomer, was immediate.

Maywick Appliances (Wickford, Essex) is a name new to mushroom growers, except those who also rear poultry or pigs. It was in fact, Mr. R. Duthy of Little Horkesley, Nr. Colchester, Essex, well-known in both fields, who first enlisted their support, and gave great assistance in the gradual development of this sterilizing unit.

The Maywick sterilizer is a convector operating on Calor Gas propane, a clean essentially portable fuel of high calorific value. At maximum pressure it produces more than three quarters of a million B.T.U.'s per hour. This means that two units standing in a reasonably well-insulated house, say 60′ by 20′, could produce air temperatures over 200° F., in a little over an hour, and temperatures in spent compost of 140° F. in 6-8 hours.

As 1 lb. of propane requires more than 200 cu. ft. of air for efficient combustion, one of the early problems which faced the manufacturers was ensuring the free flow of air to the burners. This was solved by the provision of special ducting which engages onto a sleeve on the convector and passes through either floor ventilators or a hole in the door.

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Those at present are of metal and to obviate cooling by the flow of cold air, the manufacturers recommended covering with insulating material. Later they substituted an insulating flexible duct.

Other problems followed, and were similarly solved in their turn. One obstacle remains. It was found, during a test carried out at Hegdale Nurseries, near Faversham, Kent, by courtesy of Mr. E. A. Gook and attended by other prominent growers, that although sterilization temperatures of 140° F. were reached in floor-level boxes in certain parts of the house, *cooler pockets existed elsewhere*. That sufficient heat was provided was demonstrated by the fact that air temperatures at roof level were over 250° F. and bed temperatures in upper boxes 160° F. Despite the use of two fans however it was not sufficiently displaced. In other words, sterilization, instead of being 100% was perhaps only 97% complete. It is typical of the company that 97%, or 99½%, is just not good enough. Far from disguising the facts, the manufacturers immediately circularised known interested growers in the area to the effect that, realising the importance of complete sterilization, they were not satisfied, but would press on with further tests regarding heat and air-movement.

This then is the present situation. Experiments are nearing completion, and soon it is hoped to eradicate this remaining problem, which, in any case, relates only to the more difficult type of building. In the meantime, excellent reports continue to arrive from existing users, including such well-known growers as Mr. M. C. Luxmoore of Yaxley, Mr. J. L. Kessler of Angmering, Mr. Killian of Great Baddow, Essex, and Messrs. Dean & Speller, Hoddesdon, to name only a few who are finding the Maywick Sterilizer satisfactory as a booster during peak heating and for cooking out and who praise its simplicity, portability and power.

NO MUSHROOM QUEEN IN 1958

The MGA Publicity Sub Committee, meeting on 14th January, decided that in view of the limited funds available for Publicity the proposed Mushroom Queen competition for 1958 should not be proceeded with.

A suggestion from the Executive Committee that the American Mushroom Queen might be invited over to this country was also turned down, again on the grounds of expense.

Reports indicated to the Committee that the £400 to £500 which it was proposed to spend on one or the other projects would not, especially with regard to a British Mushroom Queen, be adequate to stage the competition on a scale which would ensure its success.

MEMBERSHIP LIST OMISSION

It is regretted that the name of Messrs. Lew Davies (Smithfield) Ltd., Smithfield Market, Manchester 4, was omitted in error from the list of Associate Members published in the December *Bulletin*.

WOT! NO MUSHROOM QUEEN?

The decision of the Publicity Sub-Committee against holding a Mushroom Queen competition (see page opp.) on the grounds of expense led your Editor along the trail of 'what might have been,' and the result herewith was produced at very little expense. Miss Joan Joly is employed by the NFU at Agriculture House, where this picture was taken. She hails from Co. Kildare, Eire.

Reprinted from "PLANT PATHOLOGY," *6th June, 1957.*

THE SWARMING OF RHABDITID EELWORMS IN MUSHROOM HOUSES

By L. N. STANILAND

National Agricultural Advisory Service, Bristol

A phenomenon, which is perhaps best described as swarming, has been observed on several occasions recently in mushroom houses in Dorset. Vast numbers of Rhabditid eelworms have been observed on the surface of the peat casing, the nematodes being grouped into club-like masses containing up to about 100 individuals. Grouped thus, they are easily seen with the naked eye. Viewed by electric light in a dark mushroom house, the suface of the peat casing presents an astonishing sight with the numerous moving and glittering masses of eelworms.

Bovien (1937) has worked on the attachment of larvae of *Rhabditis* sp. to the bodies of Psychodid flies which breed in cow dung, and T. Goodey (1943) has recorded similar transport of the eelworms by flies breeding in sewage beds.

Samples of infested compost were sent to J. B. Goodey, at Rothamsted, who confirmed the eelworms as *Rhabditis* sp. but was unable to make a specific determination. He reported that no males could be found in the samples, though there were plenty of females containing developing eggs, and he concluded that the species might be parthenogenetic. He has also informed me that some species of *Rhabditis* and *Diplogaster*, which infest rotting habitats, multiply enormously and presumably consume all the available bacteria so that overpopulation phenomena ensue. Larvae of the latest generations develop to the third stage and then become what the German writers call " dauer," or resting, larvae, which are able to resist unfavourable conditions. In some circumstances the larvae will swarm, and in that state they apparently wait for flies and other small organisms to pass over the area. The mushroom houses visited in the present work have been very free from flies, but mites from infested compost have been found bearing eelworm larvae. *Rhabditis* spp. are generally considered to be bacterial feeders, and Hirschmann (1952) has shown that the protein of living bacteria is essential for reproduction.

The relationship between the eelworms and the mushroom mycelium was not clear. Although both J. B. Goodey and I have failed to establish a connection between them and yield, it does seem plain that composts heavily infested with bacteria are those which give the greatest numbers of Rhabditids.

In the present work it was found that the eelworms most frequently swarmed near doors or electric lights. Light stimuli were found to be potent initiators of the swarming habit. When peat casing, heavily infested with hydra-like masses of swarming Rhabditids, was kept moist and in the dark, it was found that the nematodes soon disappeared from the surface. But when the casing was subsequently exposed to bright

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sunlight, or electric light, signs of eelworm activity were apparent after a few minutes and the swarming process could be observed. Shortly after such exposure to light, the heads of individual larvae could be seen raised in the air and a second eelworm would then wriggle alongside one of these individuals and the two together would be able to raise a greater proportion of their lengths in the air. This process was repeated until a large number of the nematodes had formed the hydra-like masses, and the greater part of their lengths was waving about in the air above the surface of the peat. The whole process took 20-30 minutes to complete and could be controlled at will by switching the light on or off.

The eelworm masses reacted very strongly to tactile stimuli. When touched with a needle the masses collapsed and individuals adhered to the needle. Touching with a finger had the same effect and there is little doubt that the hands of workers picking mushrooms and trimming the beds are an important source of dispersal from bed to bed and house to house.

Composting was found to kill many, but not all, of the eelworms. Peak heating of compost after it had been moved into the house was consistently found to give a complete kill, as was peak heating of old compost before removal from the house. Yet houses very frequently became infested within a week or two after peak heating. The ease with which the eelworms can be spread to fresh habitats seems to be the only explanation for this rapid reinfestation.

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HIRSCHMANN, H. (1952). Die Nematoden der Wassergranze mittlefrankishen Gewasser. *Zool. Jb.*, **81**, 313-436.

LAST MONTH'S PUBLICITY CONTRIBUTIONS

The following contributions were received last month to the MGA Publicity Fund:—

***Spawn Merchant:**—
Pinkerton's Scottish Mushroom Laboratories, Millerston, Glasgow.
Monlough Food Production Co. Ltd., Ballygowan, Belfast.
H. Mount & Sons Ltd., Littlebourne, Canterbury, Kent.
S. A. F. Sampson Ltd., Oving, Chichester, Sussex.
W. Darlington & Sons Ltd., Southcourt Road, Worthing, Sussex.
Geo. Monro Ltd., Hertford Road, Waltham Cross, Herts.

Salesmen:—	£	s.	d.
A. Williamson (19) Ltd., Smithfield Market, Birmingham	5	5	0
S. Snowdon & Co. Ltd., Castlefolds Market, Sheffield	3	6	8
Others:—			
T. A. Smith, of G. W. Smith & Son (Thorpe) Ltd., Thorpe, Wakefield, Yorks.	2	2	0

*Amounts collected by spawn merchants are not for publication.

PLANNING FOR POSTERITY

Fred. Atkins writes: I concluded my report in MGA Bulletin 97 (January/58, p. 14) on the French Research Centre with the resounding phrase of Monsieur Sarazin's: " We plan for posterity ". At least, that had been my intention; but I carelessly let it slip through as planning for "prosperity ". *C'est magnifique, mais ce n'est pas la meme choes.* Forgive me, André!

CROP PROTECTION PRODUCTS APPROVED LIST

The MGA Secretary has obtained copies of the Ministry of Agriculture's Approved List, 1957, under the Crop Protection Products Approval Scheme and copies may be had on application.

The list contains a number of recommendations regarding mushroom pests together with the names and addresses of various manufacturers of these approved insecticides, fungicides and weed-killers, marketed in Great Britain under proprietary names.

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NOTTINGHAM Company require mushrooms urgently. Write for managing director to visit you. Box No. 5.

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FOR SALE: Purpose built Mushroom Farm with delightful modern Bungalow standing in 1¼ acres. Cropping area 4,000 sq. ft. shelf system, easily adapted to trays and ample room for expansion. New buildings built to specification 2 years ago. Business run by owner and wife. Price freehold £4,500. Sale due to ill health. Further details from Barber, New Street, Ash, Canterbury. Tel. Ash 472.

MUSHROOM FARM WANTED: 10,000 sq. ft. or near. To rent or with option to buy in 12 months. Box No. 3.

SHELF BEDS: Two sets, approximately 37½ ft. long by 5 ft. 8 ins. wide, comprising precast concrete scaffolding posts and cross members, with Celcure pressure-treated timber beds and side boards, all interchangeable, 5′ 4″ × 8″ × 1″, for 1,450 sq. ft. of bed space. Cost £200. Offers to Box No. 4.

VIRGINIA WATER: Mushroom Farm, fully equipped, conveyors, etc., for sale. Freehold with 7 acres of land £5,900 or Farm without the additional land £4,900. Land suitable for chicken farm, mink or other livestock. Planning permission for residence. In Green Belt. Could be let to resident grower with capital. Part mortgage available. Box No. 5.

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MUSHROOM FANATIC with 16 years technical and practical experience wants interesting and well-paid job as grower/manager on large or expandable farm, or would join anyone wishing to start from scratch. Box No. 20.

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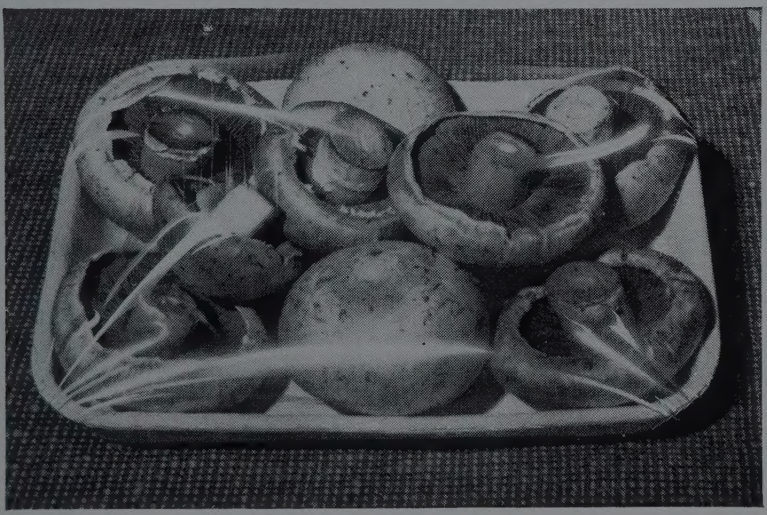

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